General

Guideline Title

American Academy of Orthopaedic Surgeons clinical practice guideline on preventing venous thromboembolic disease in patients undergoing elective hip and knee arthroplasty.

Bibliographic Source(s)

American Academy of Orthopaedic Surgeons (AAOS). American Academy of Orthopaedic Surgeons clinical practice guideline on preventing venous thromboembolic disease in patients undergoing elective hip and knee arthroplasty. Rosemont (IL): American Academy of Orthopaedic Surgeons (AAOS); 2011. 847 p. [51 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: American Academy of Orthopaedic Surgeons clinical guideline on prevention of symptomatic pulmonary embolism in patients undergoing total hip or knee arthroplasty. Rosemont (IL): American Academy of Orthopaedic Surgeons (AAOS); 2007. 63 p. [49 references]

Recommendations

Major Recommendations

Definitions of the grade of recommendations (Strong, Moderate, Limited, Inconclusive, and Consensus) are provided at the end of the "Major Recommendations" field.

Note from the American Academy of Orthopaedic Surgeons (AAOS): The following is a summary of the recommendations of the AAOS' clinical practice guideline, Preventing Venous Thromboembolic Disease in Patients Undergoing Elective Hip and Knee Arthroplasty. This summary does not contain rationales that explain how and why these recommendations were developed, nor does it contain the evidence supporting these recommendations. All readers of this summary are strongly urged to consult the full guideline and evidence report for this information. AAOS is confident that those who read the full guideline and evidence report will see that the recommendations were developed using systematic evidence-based processes designed to combat bias, enhance transparency, and promote reproducibility. This summary of recommendations is not intended to stand alone. Treatment decisions should be made in light of all circumstances presented by the patient. Treatments and procedures applicable to the individual patient rely on mutual communication between patient, physician, and other healthcare practitioners.

1. The work group recommends against routine post-operative duplex ultrasonography screening of patients who undergo elective hip or knee arthroplasty. (Grade of Recommendation: Strong)
2. Patients undergoing elective hip or knee arthroplasty are already at high risk for venous thromboembolism. The practitioner might further

assess the risk of venous thromboembolism by determining whether these patients had a previous venous thromboembolism. (Grade of Recommendation: Limited) Current evidence is not clear about whether factors other than a history of previous venous thromboembolism increase the risk of venous thromboembolism in patients undergoing elective hip or knee arthroplasty and, therefore, the work group cannot recommend for or against routinely assessing these patients for these factors. (Grade of Recommendation: Inconclusive)

3. Patients undergoing elective hip or knee arthroplasty are at risk for bleeding and bleeding-associated complications. In the absence of reliable evidence, it is the opinion of this work group that patients be assessed for known bleeding disorders like hemophilia and for the presence of active liver disease which further increase the risk for bleeding and bleeding-associated complications. (Grade of Recommendation: Consensus) Current evidence is not clear about whether factors other than the presence of a known bleeding disorder or active liver disease increase the chance of bleeding in these patients and, therefore, the work group is unable to recommend for or against using them to assess a patient's risk of bleeding. (Grade of Recommendation: Inconclusive)
4. The work group suggests that patients discontinue antiplatelet agents (e.g., aspirin, clopidogrel) before undergoing elective hip or knee arthroplasty. (Grade of Recommendation: Moderate)
5. The work group suggests the use of pharmacologic agents and/or mechanical compressive devices for the prevention of venous thromboembolism in patients undergoing elective hip or knee arthroplasty, and who are not at elevated risk beyond that of the surgery itself for venous thromboembolism or bleeding. (Grade of Recommendation: Moderate) Current evidence is unclear about which prophylactic strategy (or strategies) is/are optimal or suboptimal. Therefore, the work group is unable to recommend for or against specific prophylactics in these patients. (Grade of Recommendation: Inconclusive) In the absence of reliable evidence about how long to employ these prophylactic strategies, it is the opinion of this work group that patients and physicians discuss the duration of prophylaxis. (Grade of Recommendation: Consensus)
6. In the absence of reliable evidence, it is the opinion of this work group that patients undergoing elective hip or knee arthroplasty, and who have also had a previous venous thromboembolism, receive pharmacologic prophylaxis and mechanical compressive devices. (Grade of Recommendation: Consensus)
7. In the absence of reliable evidence, it is the opinion of this work group that patients undergoing elective hip or knee arthroplasty, and who also have a known bleeding disorder (e.g., hemophilia) and/or active liver disease, use mechanical compressive devices for preventing venous thromboembolism. (Grade of Recommendation: Consensus)
8. In the absence of reliable evidence, it is the opinion of this work group that patients undergo early mobilization following elective hip and knee arthroplasty. Early mobilization is of low cost, minimal risk to the patient, and consistent with current practice. (Grade of Recommendation: Consensus)
9. The work group suggests the use of neuraxial (such as intrathecal, epidural, and spinal) anesthesia for patients undergoing elective hip or knee arthroplasty to help limit blood loss, even though evidence suggests that neuraxial anesthesia does not affect the occurrence of venous thromboembolic disease. (Grade of Recommendation: Moderate)
10. Current evidence does not provide clear guidance about whether inferior vena cava (IVC) filters prevent pulmonary embolism in patients undergoing elective hip and knee arthroplasty who also have a contraindication to chemoprophylaxis and/or known residual venous thromboembolic disease. Therefore, the work group is unable to recommend for or against the use of such filters. (Grade of Recommendation: Inconclusive)

Definitions:

Levels of Evidence: See the "Rating Scheme for the Strength of the Evidence" field.

Grades of Recommendation

Guideline Language	Grade of Recommendation	Description of Evidence
The work group *recommends*	Strong	Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.
The work group *suggests*	Moderate	Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.
The Practitioner *might*	Limited	Evidence from two or more "Low" strength studies with consistent findings, or evidence from a single study for recommending for against the intervention or diagnostic.
The work group *is unable to recommend for or against*	Inconclusive	The evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.

Guideline Language	Grade of Recommendation*	Description of Evidence
In the absence of reliable evidence, the *opinion* of the work group is*	Consensus*	There is no supporting evidence. In the absence of reliable evidence, the work group is making a recommendation based on their clinical opinion considering the known harms and benefits associated with the treatment.

*Consensus based recommendations are made according to specific criteria. These criteria can be found in Section III of the original guideline document.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Venous thromboembolic disease after hip and knee arthroplasty

Guideline Category

Management

Prevention

Risk Assessment

Treatment

Clinical Specialty

Anesthesiology

Hematology

Orthopedic Surgery

Physical Medicine and Rehabilitation

Preventive Medicine

Intended Users

Advanced Practice Nurses

Hospitals

Nurses

Physical Therapists

Physician Assistants

Physicians

Guideline Objective(s)

- To help improve screening, prevention, and treatment of thromboembolic disease in patients undergoing total hip or knee arthroplasty based on the current best evidence
- To guide qualified physicians through a series of treatment decisions in an effort to improve the quality and efficiency of care of patients at risk of thromboembolic disease after hip or knee arthroplasty
- To serve as an information resource for medical practitioners
- To assist practitioners describing, to patients and others, why the chosen treatment represents the best available course of action

Target Population

Patients undergoing elective hip and knee arthroplasty

Note: The guideline is not intended for treatment of patients who present with venous thromboembolic disease.

Interventions and Practices Considered

Risk Assessment

Preoperative assessment for risk of:

- Venous thromboembolism
- Bleeding disorders such as hemophilia
- Liver disease

Management/Prevention/Treatment

1. Discontinuation of antiplatelet agents before surgery
2. Pharmacological prophylaxis
3. Discussion of specific duration of prophylaxis
4. Mechanical compression devices
5. Early mobilization
6. Use of neuraxial (such as intrathecal, epidural, and spinal) anesthesia

Note: The work group considered but recommended against routine post-operative duplex ultrasonography screening. The work group is unable to recommend for or against the use of inferior vena cava (IVC) filters to prevent pulmonary embolism in patients undergoing elective hip and knee arthroplasty who also have a contraindication to chemoprophylaxis and/or known residual venous thromboembolic disease.

Major Outcomes Considered

- All cause mortality
- Death from bleeding
- Death from pulmonary embolism (PE)
- Periprosthetic joint infection
- Reoperation due to bleeding
- Reoperation for any reason within 90 days of surgery
- Symptomatic PE
- Symptomatic or proximal deep venous thrombosis (DVT)
- Major bleeding

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Study Selection Criteria

The American Academy of Orthopaedic Surgeons (AAOS) work group developed *a priori* article inclusion criteria for the systematic reviews for each preliminary recommendation. These criteria are the "rules of evidence." Articles that did not meet them are, for the purposes of this guideline, not evidence.

To be included in the work group's systematic reviews (and hence, in this guideline) an article had to be a report of a study that:

- Investigated elective hip and knee arthroplasty patients
- Was a full article report of a clinical study
- Was not a retrospective case series
- Was not a medical records review, meeting abstract, historical article, editorial, letter, or a commentary
- If a prospective case series, reported baseline values
- Case series studies that have non-consecutive enrollment of patients are excluded
- Appeared in a peer-reviewed publication or a registry report
- Enrolled 100 or more patients per arm for studying deep vein thrombosis or pulmonary embolism, and more than 10 patients per arm per intervention (20 total) for all other outcomes
- Was of humans
- Was published in or after 1966
- Quantitatively presented results
- Was not an *in vitro* study
- Was not a biomechanical study
- Was not performed on cadavers
- Was published in English

The restriction on English language papers is unlikely to influence the recommendations in the present clinical practice guideline. An umbrella review of systematic reviews on language restriction found that none of the systematic reviews provided empirical evidence that excluding non-English language studies resulted in biased estimates of an intervention's effectiveness.

The work group did not include systematic reviews or meta-analyses conducted by others, or guidelines by others. These documents are developed using different inclusion criteria than those specified by the AAOS work group. Therefore, they may include studies that do not meet the work group's inclusion criteria. The work group recalled these documents if its abstract suggested that it might address one of the work group's recommendations, and the work group searched the bibliographies for additional studies.

Literature Searches

The AAOS work group searched for articles published from January 1966 to February 24, 2011. The work group searched four electronic databases: PubMed, EMBASE, CINAHL, and The Cochrane Central Register of Controlled Trials. Strategies for searching electronic databases were constructed by the AAOS Medical Librarian using previously published search strategies to identify relevant studies.

The work group supplemented searches of electronic databases with manual screening of the bibliographies of all retrieved publications. The work group also searched the bibliographies of recent systematic reviews and other review articles for potentially relevant citations. All articles identified were subject to the study selection criteria listed above. As noted above, the guideline work group also examined lists of included and excluded studies for errors and omissions.

The work group went to these lengths to obtain a complete set of relevant articles. Having a complete set ensures that the guideline is not based on a biased subset of articles.

The study attrition diagram in Appendix IV of the original guideline document provides details about the inclusion and exclusion of the studies considered for this guideline. The search strategies used to identify these studies are provided in Appendix V of the original guideline document.

Number of Source Documents

205 articles were included.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Appraising Evidence Quality and Applicability

Studies of Interventions

Quality

The work group separately evaluated the quality of evidence for each outcome reported by each study. This follows the suggestion of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) working group and others. The work group evaluated quality using a domain-based approach. Such an approach is used by the Cochrane Collaboration. Unlike the Cochrane Collaboration's scheme (which is for studies with parallel control groups), the AAOS scheme allows for evaluation of studies of all designs. The domains used are whether:

- The study was prospective (with prospective studies, it is possible to have an a priori hypothesis to test; this is not possible with retrospective studies.)
- The study was of low statistical power
- The assignment of patients to groups was unbiased
- There was blinding to mitigate against a placebo effect
- The patient groups were comparable at the beginning of the study
- The intervention was delivered in such a way that any observed effects could reasonably be attributed to that intervention
- Whether the instruments used to measure outcomes were valid
- Whether there was evidence of investigator bias

Each quality domain is addressed by one or more questions that are answered "Yes," "No," or "Unclear." These questions and the domains that each addresses are shown in Appendix VI of the original guideline document.

To arrive at the quality of the evidence for a given outcome, all domains except the "Statistical Power" domain are termed as "flawed" if one or more questions addressing any given domain are answered "No" for a given outcome, or if there are two or more "Unclear" answers to the questions addressing that domain. The "Statistical Power" domain is considered flawed if a given study did not enroll enough patients to detect a standardized difference between means of 0.2.

Domain flaws lead to corresponding reductions in the quality of the evidence. The manner in which the work group conducted these reductions is shown in the table below (Table 3 in the original guideline document). For example, the evidence reported in a randomized controlled trial (RCT) for any given outcome is rated as "High" quality if zero or one domain is flawed. If two or three domains are flawed for the evidence addressing this outcome, the quality of evidence is reduced to "Moderate," and if four or five domains are flawed, the quality of evidence is reduced to "Low." The quality of evidence is reduced to "Very Low" if six or more domains are flawed.

Relationship between Quality and Domain Scores for Interventions

Number of Flawed Domains	Strength of Evidence
0-1	High
2-3	Moderate
4-5	Low
>5	Very Low

Although the work group mentions levels of evidence in this guideline, it is done so only to provide some very general information about study quality to those readers familiar with the levels of evidence system of *The Journal of Bone and Joint Surgery - American*. However, for the reasons noted above, the work group does not use levels of evidence as when speaking of "quality" in this document, and levels of evidence play no role in our determination of the grade of the final recommendations.

Applicability

The AAOS work group rated the applicability (also called "generalizability" or "external validity") of the evidence for each outcome reported by each study. As with quality, applicability ratings were determined by a computer program that used predetermined questions about specific applicability domains. The work group rated applicability as either "High", "Moderate", or "Low" depending on how many domains are flawed. As with quality, a domain is "flawed" if one or more questions addressing that domain is answered "No" or if two or more are answered "Unclear." The work group characterized a domain as "flawed" if one or more questions addressing any given domain are answered "No" for a given outcome, or if there are two or more "Unclear" answers to the questions addressing that domain (see Appendix VI in the original guideline document for the specific applicability questions employed and the domains that each question addresses).

The work group's questions and domains about applicability are those of the PRECIS instrument. The instrument was originally designed to evaluate the applicability of randomized controlled trials, but it can also be used for studies of other design. The questions in this instrument fall into four domains. These domains and their corresponding questions are shown in Appendix VI of the original guideline document. As shown in Table 4 in the original guideline document, the applicability of a study is rated as "High" if it has no flawed domains, as "Low" if all domains are flawed, and as "Moderate" in all other cases.

Refer to Section III of the original guideline document for a description of the methods used to determine the quality and applicability of evidence for the following types of studies:

- Studies of screening and diagnostic tests
- Studies of prognostics

Methods Used to Analyze the Evidence

Meta-Analysis of Randomized Controlled Trials

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Best Evidence Synthesis

The work group included only the best available evidence for any given outcome addressing a recommendation. Accordingly, the group first included the highest quality evidence for any given outcome if it was available. In the absence of two or more studies that reported an outcome at this quality, the work group considered studies of the next lowest quality until at least two or more occurrences of an outcome had been acquired. For example, if there were two "Moderate" quality studies that reported an outcome, the work group did not include "Low" quality studies that also reported this outcome, but if there was only one "Moderate" quality study that reported an outcome, the work group also included "Low" quality studies.

Statistical Methods

The American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guidelines Unit performed network meta-analyses (also known as a mixed treatment comparisons analyses) to ascertain the comparative effectiveness of strategies for preventing venous thromboembolism. All of the trials entered into the analyses were randomized controlled trials (most, but not all, were of "High" quality; additional details on their quality are presented in the sections of this guideline that present the results of the appraisal of these studies). Some of the trials that met the original inclusion criteria did not observe any events in any of their groups. In accordance with suggestions of the Cochrane collaboration, those trials were excluded from the analyses.

The work group compared the treatments of interest to both placebo (or no treatment) and enoxaparin. Although the comparisons to placebo are easier to interpret, more of the published comparisons are to enoxaparin than any other treatment. This means that the comparisons to enoxaparin have greater precision than the comparisons to placebo. None of the studies that report all-cause mortality in the final model used a placebo comparator. Therefore, the work group only presents the comparisons to enoxaparin.

Analyses were performed using Winbugs v 1.4.3. This method preserves the randomization of the original trials. The Markov chains in the model were said to have converged if plots of the Gelman-Rubin statistics indicated that widths of pooled runs and individual runs stabilized around the same value and their ratio was approximately one. In general, the work group performed 100,000 iterations, the first 50,000 of which were discarded as "burn in" iterations for each of the network models described. The one exception was the initial analysis of major bleeding, in which a burn in of 150,000 iterations was used. The work group specified vague priors for the trial baselines and the basic parameters (normal distribution with mean 0 and variance 10,000) and for the random effects standard deviation (uniform distribution: U[0,2]). The work group uses $p < 0.05$ to define statistical significance.

To assess the adequacy of the statistical models, the work group checked the overall fit by comparing the posterior mean deviance to the number of data points in any given model. These two figures are approximately equal for models that fit the data well. The work group also checked the statistical consistency of the models using a "back-calculation" method for networks with direct evidence from multi-arm trials. This method requires point estimates and dispersions of the trial data being entered into the network meta-analysis. When there were two or more trials comparing two of the same treatments, the work group obtained these latter two quantities from meta-analytic models computed using the Peto odds ratio as the test statistic. This statistic is the optimal way to compute the odds ratio when events are sparse. All traditional meta-analyses were performed using STATA 10.0.

Refer to Section III of the original guideline document under "Statistical Methods" for additional information.

Methods Used to Formulate the Recommendations

Expert Consensus (Nominal Group Technique)

Description of Methods Used to Formulate the Recommendations

To develop this guideline, the work group held an introductory meeting on March 27, 2010 to establish the scope of the guideline and the systematic reviews. Upon completing the systematic reviews, the work group participated in a two-day recommendation meeting on April 2 and 3, 2011 at which time the final recommendations and rationales were edited, written, and voted on.

Formulating the Preliminary Recommendations

The work group determined the scope of the guideline by constructing a set of preliminary recommendations. These recommendations specify [what] should be done in [whom], [when], [where], and [how often or how long]. This is similar to the PICO (patients, interventions, comparisons, and outcomes) format used when the scope of a guideline is framed using key questions instead of preliminary recommendations. The preliminary recommendations function as questions for the systematic reviews that underpin each preliminary recommendation, not as final recommendations or conclusions. To avoid "wordsmithing" discussions at the initial work group meeting, the preliminary recommendations are always worded as recommending for something.

Once established, these preliminary recommendations cannot be modified until the final work group meeting. At this time, they can only be modified in accordance with the available evidence and only in accordance with the AAOS rules for how the wording of a recommendation depends on the grade of recommendation (see below for information about this wording). No modifications of the preliminary recommendations can require new literature searches and, at the final work group meeting, no recommendations can be added that require the use of expert opinion.

Full Disclosure Information

All of the work group's preliminary recommendations are represented in this guideline. This ensures full disclosure of the information that the AAOS work group examined, and assures readers that they are seeing all the information, and not just a selected portion of it.

Voting on the Recommendations

The recommendations and their strength were voted on using a structured voting technique known as the nominal group technique. The work group present details of this technique in Appendix VIII of the original guideline document. Voting on guideline recommendations is conducted using a secret ballot and work group members are blinded to the responses of other members. If disagreement between work group members is significant, there is further discussion to see whether the disagreement(s) can be resolved. Up to three rounds of voting are held to attempt to resolve disagreements. If disagreements are not resolved following three voting rounds, no recommendation is adopted. Lack of agreement is a reason that the grade of some recommendations can be labeled "Inconclusive."

Formal votes on all recommendations that are evidence-based or that read "the work group is unable to recommend for or against" are only on the

recommendations. The rationales require only approval of the work group chair and the methodologists unless the recommendation is consensus-based. Both the recommendation and the rationale of a consensus –based recommendation are the subject of formal votes.

Rating Scheme for the Strength of the Recommendations

Grades of Recommendation

The work group used quality and applicability ratings in conjunction with consistency, whether the studies reported outcomes that the work group deemed "critical," and the potential for catastrophic harm to determine the final grade of recommendation. More specifically, the work group began by setting the grade as equal to the quality of the available evidence. In other words, high quality evidence is preliminarily taken as a "Strong" grade, moderate quality as a "Moderate" grade, and low quality as a "Limited" grade. The work group then adjusted the grade down one step if the evidence is of "Low" applicability, is inconsistent (defined as studies that report qualitatively different effects, a heterogeneous meta-analysis, or a network meta-analysis with statistically significant inconsistency), if there is only one study that addresses a given recommendation, or if a majority of the outcomes deemed "critical" are not reported in the literature. Preliminary grades were adjusted upwards if the evidence is of "High" applicability or if providing the intervention decreases the potential for catastrophic harm (loss of life or limb). Preliminary grades were adjusted downward if the evidence is of "Low" applicability or if the medical service in question is accompanied with catastrophic harm. In the present guideline, catastrophic harm did not occur frequently enough to allow for increasing or decreasing the preliminary grade. For a recommendation of a "Strong" grade, a minimum of two high quality studies are needed. A minimum of two moderate quality studies are required for a "Moderate" grade, and a minimum of two low quality studies are needed for a "Limited" grade. Recommendations addressed by only very low quality studies are consensus-based.

Wording of the Recommendations

To prevent biased nuances in the way recommendations are worded, the AAOS uses predetermined, specific language for its recommendations. The exact wording is governed by the final grade of the recommendation.

Guideline Language	Grade of Recommendation	Description of Evidence
The work group *recommends*	Strong	Evidence from two or more "High" strength studies with consistent findings for recommending for or against the intervention.
The work group *suggests*	Moderate	Evidence from two or more "Moderate" strength studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.
The Practitioner *might*	Limited	Evidence from two or more "Low" strength studies with consistent findings, or evidence from a single study for recommending for against the intervention or diagnostic.
The work group *is unable to recommend for or against*	Inconclusive	The evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.
In the absence of reliable evidence, the *opinion* of the work group is*	Consensus*	There is no supporting evidence. In the absence of reliable evidence, the work group is making a recommendation based on their clinical opinion considering the known harms and benefits associated with the treatment.

*Consensus based recommendations are made according to specific criteria. These criteria can be found in Section III of the original guideline document.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

Peer Review

A draft of the present guideline was peer reviewed. Peer review was performed using a structured peer review form (see Appendix IX in the original guideline document). This form requires all peer reviewers to declare their conflicts of interest.

To determine who would serve as peer reviewers, the work group nominated external specialty societies before work on the guideline began. By having work groups specify *organizations* for review (as opposed to individuals), the work group is attempting to prevent overly favorable reviews that could arise should work group members choose reviewers with whom they had personal or professional relationships. The work group also blinds peer reviewers to the identities of the work group members when they peer review the draft.

The outside specialty societies were nominated at the beginning of the process and solicited for names of peer reviewers approximately six weeks before the final recommendation meeting for a guideline. The physician members of the American Academy of Orthopaedic Surgeons (AAOS) Guidelines Oversight Committee and the Evidence Based Practice Committee review all draft AAOS clinical practice guidelines.

The clinical practice guidelines manager drafted initial responses to comments about methodology. These responses were then reviewed by the work group chair and vice-chair, who also responds to questions concerning clinical practice and techniques, and the AAOS Director of Research and Scientific Affairs. All changes to a recommendation as a result of peer review input were voted on and accepted by a majority of the work group members via teleconference. All changes to any guideline recommendation must be based on the evidence. Final changes to the guideline are incorporated, detailed in a summary sheet and forwarded with the document through the rest of the review and approval process.

The AAOS believes that it is important for guideline developers to demonstrate that they are responsive to peer review. Accordingly, after the AAOS Board of Directors approves a guideline, the AAOS posts all peer reviewer comments on its website (see http://www.aaos.org/research/guidelines/guide.asp to access these documents) with a point-by-point description of how the AAOS responded to each non-editorial comment made by each reviewer. Reviewers who wish to remain anonymous can notify the AAOS, and their names will be redacted; their comments, AAOS responses and their conflicts of interest will however still be posted for review.

Twenty-six outside organizations were solicited to provide peer reviewers for this document. The draft of this guideline was sent to 25 review organizations who responded to the solicitation and a total of 33 peer reviewers received the document not including the AAOS Evidence-based Practice Committee and Guidelines Oversight Committee members. Twelve of these reviewers returned comments (see Appendix IX of the original guideline document). The disposition of all non-editorial peer review comments was documented and accompanied this guideline through the public commentary and the AAOS guideline approval process.

Public Commentary

After modifying the draft in response to peer review, the guideline was sent for a thirty day period of "Public Commentary." Public Commentators are blinded to the identities of the work group members. Commentators consist of members of the AAOS Board of Directors (BOD), members of the Council on Research and Quality (CORQ), members of the Board of Councilors (BOC), and members of the Board of Specialty Societies (BOS). AAOS guidelines are automatically forwarded to the AAOS BOD and CORQ for commentary. Members of the BOC and BOS are solicited for interest. If they ask to see the document, it is forwarded to them. For this guideline, 20 members not including the CORQ and the AAOS BOD, received the draft for comment.

The draft guideline is, if warranted, modified in response to public commentary by the AAOS Clinical Practice Guidelines Unit and the work group members. If changes are made as a result of public comment, these changes are summarized, and those who provided commentary are notified that their input resulted in a change in the guideline. Changes as a result of public commentary must be based on evidence. All changes are detailed in a summary sheet that accompanies the document through the approval process. Over 200 commentators have had the opportunity to provide input into this guideline (see Appendix X in the original guideline document).

The AAOS Guideline Approval Process

This final guideline draft was approved by the AAOS Evidence Based Practice Committee, the AAOS Guidelines Oversight Committee, the AAOS Council on Research and Quality, and the AAOS Board of Directors. Descriptions of these bodies are provided in Appendix II in the original guideline document. These reviewing bodies do not have the option to modify the draft guideline during the approval process. They can

only vote to approve it or reject it. Accordingly, no changes were made to this guideline during the approval process.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is specifically stated for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate risk assessment and thromboprophylactic therapy in patients undergoing hip or knee replacement therapy

Potential Harms

Adverse events including major bleeding

Contraindications

Contraindications

Most treatments are associated with some known risks, especially invasive and operative treatments. In addition, contraindications vary widely based on the treatment administered. Therefore, discussion of available treatments and procedures applicable to the individual patient rely on mutual communication between the patient and physician, weighing the potential risks and benefits for that patient.

Qualifying Statements

Qualifying Statements

- This clinical guideline was developed by an American Academy of Orthopaedic Surgeons (AAOS) physician volunteer Work Group and experts in systematic reviews. It is provided as an educational tool based on an assessment of the current scientific and clinical information and accepted approaches to treatment. The recommendations in this guideline are not intended to be a fixed protocol as some patients may require more or less treatment or different means of diagnosis. Patients seen in clinical practice may not be the same as those found in a clinical trial. Patient care and treatment should always be based on a clinician's independent medical judgment given the individual clinical circumstances.
- Some drugs or medical devices referenced or described in this clinical practice guideline may not have been cleared by the Food and Drug Administration (FDA) or may have been cleared for a specific use only. The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or device he or she wishes to use in clinical practice.
- This guideline should not be construed as including all proper methods of care or excluding methods of care reasonably directed to obtaining the same results. The ultimate judgment regarding any specific procedure or treatment must be made in light of all circumstances presented by the patient and the needs and resources particular to the locality or institution.

Implementation of the Guideline

Description of Implementation Strategy

Guideline Dissemination Plans

The primary purpose of the present document is to provide interested readers with full documentation about not only the recommendations, but also about how the work group arrived at those recommendations. This document is also posted on the American Academy of Orthopaedic Surgeons (AAOS) website at http://www.aaos.org/research/guidelines/guide.asp .

Shorter versions of the guideline are available in other venues. Publication of most guidelines is announced by an Academy press release, articles authored by the work group and published in the Journal of the American Academy of Orthopaedic Surgeons, and articles published in AAOS *Now*. Most guidelines are also distributed at the AAOS Annual Meeting in various venues such as on Academy Row and at Committee Scientific Exhibits.

Selected guidelines are disseminated by webinar, an Online Module for the Orthopaedic Knowledge Online website, Radio Media Tours, Media Briefings, and by distributing them at relevant Continuing Medical Education (CME) courses and at the AAOS Resource Center.

Other dissemination efforts outside of the AAOS will include submitting the guideline to the National Guideline Clearinghouse and distributing the guideline at other medical specialty societies' meetings.

Implementation Tools

Patient Resources

Quick Reference Guides/Physician Guides

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Staying Healthy

IOM Domain

Effectiveness

Patient-centeredness

Safety

Identifying Information and Availability

Bibliographic Source(s)

American Academy of Orthopaedic Surgeons (AAOS). American Academy of Orthopaedic Surgeons clinical practice guideline on preventing venous thromboembolic disease in patients undergoing elective hip and knee arthroplasty. Rosemont (IL): American Academy of Orthopaedic Surgeons (AAOS); 2011. 847 p. [51 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2007 (revised 2011)

Guideline Developer(s)

American Academy of Orthopaedic Surgeons - Medical Specialty Society

Source(s) of Funding

The American Academy of Orthopaedic Surgeons exclusively funded this clinical practice guideline. The Academy received no funding from outside commercial sources to support the development of this document.

Guideline Committee

American Academy of Orthopaedic Surgeons (AAOS) Pulmonary Embolism Work Group

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

In accordance with American Academy of Orthopaedic Surgeons (AAOS) policy, all individuals whose names appear as authors or contributors to this clinical practice guideline filed a disclosure statement as part of the submission process. All panel members provided full disclosure of potential conflicts of interest prior to beginning work on the recommendations contained within this clinical practice guideline.

Conflicts of interest are disclosed in writing with the American Academy of Orthopaedic Surgeons via a private on-line reporting database and also verbally at the recommendation approval meeting.

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: American Academy of Orthopaedic Surgeons clinical guideline on prevention of symptomatic pulmonary embolism in patients undergoing total hip or knee arthroplasty. Rosemont (IL): American Academy of Orthopaedic Surgeons (AAOS); 2007. 63 p. [49 references]

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the American Academy of Orthopaedic Surgeons Web site

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Print copies: Available from the American Academy of Orthopaedic Surgeons, 6300 North River Road, Rosemont, IL 60018-4262. Telephone: (800) 626-6726 (800 346-AAOS); Fax: (847) 823-8125; Web site: www.aaos.org .

Availability of Companion Documents

The following is available:

- Preventing venous thromboembolic disease in patients undergoing elective hip and knee arthroplasty. Summary of recommendations. Electronic copies: Available in Portable Document Format (PDF) from the American Academy of Orthopaedic Surgeons Web site .

Print copies: Available from the American Academy of Orthopaedic Surgeons, 6300 North River Road, Rosemont, IL 60018-4262. Telephone: (800) 626-6726 (800 346-AAOS); Fax: (847) 823-8125; Web site: www.aaos.org .

Patient Resources

The following is available:

- Deep vein thrombosis. Rosemont (IL): American Academy of Orthopaedic Surgeons. 2009 Jan. Available from the American Academy of Orthopaedic Surgeons (AAOS) Web site .

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NGC Status

This NGC summary was completed by ECRI Institute on July 10, 2007. The information was verified by the guideline developer on July 26, 2007. This summary was updated by ECRI Institute on September 7, 2007 following the revised U.S. Food and Drug Administration (FDA) advisory on Coumadin (warfarin). This summary was updated by ECRI Institute on March 14, 2008 following the updated FDA advisory on heparin sodium injection. This summary was updated by ECRI Institute on December 26, 2008 following the FDA advisory on Innohep (tinzaparin). This NGC summary was updated by ECRI Institute on March 13, 2012.

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